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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/672,753

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Juha Heiskala

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05/04/2004

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EXAMINER

AHN, SAM K

ART UNIT

PAPER NUMBER

2634

11

DATE MAILED: 05/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/672,753

Applicant(s)

HEISKALA ET AL.

Examiner

Sam K. Ahn

Art Unit

2634

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on amendment, received on 3/9/04.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4 and 6-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 21 is/are allowed.
- 6) ☒ Claim(s) 1-4 and 7-20 is/are rejected.
- 7) ☒ Claim(s) 6 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed on 03/09/04 have been fully considered but they are not persuasive. Applicants have amended claims 1 and 13 to overcome the reference by Alamouti by adding the limitation of *the N-dimensional, trellis-encoded sequences of dimensional values greater than two*. Alamouti uses two-dimensional trellis-encoded modulation as the multi-dimensional trellis-coded modulator having transmit diversity by using two transmit antennas and M receive antenna, which provides the diversity order of 2M at the receiver. (note paragraph 1 and 4, p.704) However, Alamouti does not teach wherein dimensional value is greater than two. Wei (cited previously) teaches multi-dimensional trellis-coded modulation for fading channels and classifies trellis-coded modulator into: two-dimensional trellis-coded modulation and multi-dimensional trellis-coded modulation. (note col.1, lines 23-25) And, Wei further illustrates multi-dimensional trellis-coded modulation. (see Fig.4-7) Therefore, it would have been obvious to one skilled in the art at the time of the invention to implement multi-dimensional trellis-coded modulation, as taught by Wei, in Alamouti's system in the multi-dimensional trellis-coded modulator means for the purpose of taking advantage of the multi-dimensional trellis-coded modulation has over the two-dimensional trellis-coded modulation, such as higher coding gains and lower decoder complexities when used in fading channels, as taught by Wei. (note col.1, lines 26-61)

Therefore, Alamouti in view of Wei teach all subject matter claimed.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-4 and 7-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alamouti (cited previously) in view of Wei (cited previously).

Regarding claims 1 and 13, Alamouti discloses a method and apparatus in a communication system having a sending station (see Fig.2) for sending data upon a communication channel comprising a multi-dimensional trellis-coded modulator coupled to receive indications of the data to be sent by the sending station, said multi-dimensional trellis-coded modulator for forming N-dimensional (two) trellis-encoded sequences therefrom. (see Fig.2 where the data from binary source is converted by TCM encoder and modulated) Further, a first and at least a second transmit antenna coupled to said multi-dimensional trellis-coded modulator (see Fig.1 and 2), a first and second N-dimensional sequences transduced by its corresponding transmit antenna (note Table 1, and note p.704-706), and providing orthogonal transmit diversity.

Alamouti uses two-dimensional trellis-encoded modulation as the multi-dimensional trellis-coded modulator having transmit diversity by using two transmit antennas and M receive antenna, which provides the diversity order of

2M at the receiver. (note paragraph 1 and 4, p.704) However, Alamouti does not teach wherein dimensional value is greater than two. Wei (cited previously) teaches multi-dimensional trellis-coded modulation for fading channels and classifies trellis-coded modulator into: two-dimensional trellis-coded modulation and multi-dimensional trellis-coded modulation. (note col.1, lines 23-25) And, Wei further illustrates multi-dimensional trellis-coded modulation. (see Fig.4-7) Therefore, it would have been obvious to one skilled in the art at the time of the invention to implement multi-dimensional trellis-coded modulation, as taught by Wei, in Alamouti's system in the multi-dimensional trellis-coded modulator means for the purpose of taking advantage the multi-dimensional trellis-coded modulation has over the two-dimensional trellis-coded modulation, such as higher coding gains and lower decoder complexities when used in fading channels.

Regarding claims 2, 9, 14 and 15, Alamouti in view of Wei teach all subject matter claimed, as applied to claim 1 or 13. Alamouti further teaches encoding the data, mapping the (OFDM) multi-dimensional trellis-codes prior to modulating. (note Table 1, and note p.704-706) The Examiner assumes that claim 9, where the "said multi-dimensional trellis codes" is "said multi-dimensional trellis encoded modulator".

Regarding claims 3 and 16, Alamouti in view of Wei teach all subject matter claimed, as applied to claim 2 or 15. Alamouti further teaches mapping is positioned into subsets (see Table 1) of selected minimum squared distances. (note column 2 in p.705)

Regarding claims 4 and 17, Alamouti in view of Wei teach all subject matter claimed, as applied to claim 1. However, Alamouti does not explicitly teach a rule of correspondence in a convolutional encoding, wherein intrasubset and intersubset is implemented. Wei teaches, in the same field of endeavor, trellis modulation implementing intrasubset and intersubset and as a result minimizes time diversity in the multidimensional trellis code. (note col.2, lines 17-54)

Therefore, it would have been obvious to one skilled in the art at the time of invention to add an interleaver with intrasubset and intersubset for the purpose of reducing time diversity, as taught by Wei, and improve overall performance of the system.

Regarding claim 7, Alamouti in view of Wei teach all subject matter claimed, as applied to claim 1. Alamouti further teaches the multi-dimensional trellis-encoded modulator utilizing a Wei construction, having a multi-dimensional construction. (note Table 1, and note p.704-706)

Regarding claims 8 and 18, Alamouti in view of Wei teach all subject matter claimed, as applied to claim 1 or 13. Alamouti further teaches wherein the first and second N-dimensional sequences applied to said first and second transmit antennas, respectively, comprise Radon-Hurwitz transforms, as having equivalent construction. (note Table 1, and note p.704-706)

Regarding claim 10, Alamouti in view of Wei teach all subject matter claimed, as applied to claim 1. Furthermore, Alamouti teaches a demodulator (see Fig.3, rx chain) coupled to receive indications of the data received at the receiving station, said demodulator for demodulating the indications to form separate sequences, the separate sequences used to estimate symbol values. (note p.706-707)

Regarding claims 11 and 19, Alamouti teaches all subject matter claimed, as applied to claim 1 or 13. The environment of Alamouti's system is related to a wireless communication system implementing trellis coded modulation and transmit diversity for the purpose of increasing coding gains. As fading is a problem in any wireless communication environment, although Alamouti does not explicitly disclose using the system in a WLAN environment, it would have been obvious to one skilled in the art at the time of invention to implement in any environment with fading problems, as Alamouti's system pursues to overcome the problem. A method or apparatus capable of overcoming a fading problem or having an advantage of having a coding gain, one skilled in the art would be

motivated to implement the same method or apparatus in any other environment, where Fig.2 may be viewed as an access point, such as WLAN for the purpose of overcoming the same problem and having the same advantage.

Regarding claims 12 and 20, Alamouti in view of Wei teach all subject matter claimed, as applied to claim 11 or 19. Although Alamouti does not explicitly disclose the data communicated by said first and second transmit antennas communicating at a rate specified by IEEE 802.11 standard, it is inherent that the system functions as recited since the standard is mainly for WLAN, it would have been obvious to one skilled in the art to communicate at the specific rate for the purpose of effectively transmitting and receiving data, otherwise, the system would not operate seamlessly with other systems operating under the same standard.

Allowable Subject Matter

3. Claim 21 is allowed.
4. Claim 6 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
5. The following is a statement of reasons for the indication of allowable subject matter:
Present application discloses a multi-dimensional trellis-encoded modulation in a

transmitter where a first dimensional sequence is transmitted through a first antenna, while a second dimensional sequence is transmitted through a second antenna. As a result, maintains spectral efficiency and improve error rate performance. Closest prior art, Alamouti, teaches in the same field of endeavor, all subject matter recited. Wei, another close art, teaches interleaving data following a rule of correspondence by implementing a intersubset and intrasubset. However, Alamouti nor Wei teaches or suggests the teaching of defining intersubset transitions to shorter-than-average length transitions or defining intrasubset transitions to longer-than-average length transitions. Therefore, prior art do not teach or suggest all the limitation claimed.

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from

the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Sam Ahn** whose telephone number is **(703) 305-0754**.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Stephen Chin**, can be reached at **(703) 305-4714**.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks
P.O. Box 1450
Alexandria, VA 22313-1450

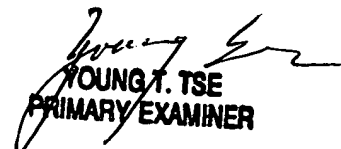
or faxed to:

(703) 872-9306

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA., Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 306-0377.

Sam K. Ahn
4/27/04


YOUNG T. TSE
PRIMARY EXAMINER